

NOAA COLLABORATIVE STUDY REVEALS CRITICAL DISCOVERY RELATED TO HARMFUL ALGAL TOXINS

Published in [Nature](#) magazine, a new collaborative study conducted in part by the National Oceanic and Atmospheric Administration reveals the molecular basis for resistance and accumulation of paralytic shellfish toxins (PSTs) in softshell clams. This collaborative study, supported by grants from NOAA's Ecology and Oceanography of Harmful Algal Blooms (ECOHAB) program and from the National Institutes of Health, has important implications for management and monitoring of human health impacts and coastal shellfisheries, as well as our understanding of harmful algae worldwide. NOAA is an agency of the U.S. Department of Commerce.

Entitled, *A Molecular Basis for Differential Susceptibility and Accumulation of Paralytic Shellfish Poisoning Toxins in Commercial Bivalves*, the study was carried out by Vera Trainer, NOAA; V. Monica Bricelj, National Research Council in Canada; Laurie Connell, University of Maine; and Keiichi Konoki, Todd Scheuer, and William A. Catterall, University of Washington. Paralytic shellfish poisoning is a persistent problem along the East and West Coasts of the United States and is caused by algae that naturally produce PSTs. Shellfish feed on these toxic algae and can accumulate concentrations of toxins unsafe for human consumption.

"Harmful algal blooms pose a serious threat to human health and are economically challenging to our coastal communities," said retired Navy Vice Admiral [Conrad C. Lautenbacher](#), Jr., Ph.D., under secretary of commerce for oceans and atmosphere and NOAA administrator. "This study supports NOAA's mission to enhance the public's understanding of environmental issues and is critical to improving our understanding of marine biotoxins and their impacts on marine foodwebs, fisheries and people."

Saxitoxin and other PSTs are potent neurotoxins that block movement of sodium through sodium channels in nerve cell membranes, halting the flow of nerve impulses and thereby causing paralysis. Humans who consume affected shellfish can suffer from the paralytic effects of these toxins. There is currently no antidote for paralytic shellfish poisoning, and all cases require immediate medical attention. This research project began in the late 1990s with the finding that softshell clams from an area that is frequently impacted by harmful algal blooms are resistant to the toxic effects of PSTs compared to softshell clams from areas that have not experienced harmful algal blooms.

"We have known for years that different shellfish species vary in their resistance and accumulation of toxins, but this is the first time that we have found a genetic change that causes toxin resistance within the same species," said Vera Trainer, a program manager at NOAA's Northwest Fisheries Science Center and one of the scientists involved in this study.

In subsequent research, the scientists discovered that the resistance to PSTs is caused by a mutation in the gene for sodium channels, which makes them more than 1000 times less sensitive to saxitoxin. This toxin resistance allows the clams to survive and feed during harmful algal blooms and thereby accumulate the high levels of PSTs that cause paralytic shellfish poisoning in humans.

"With this information we may be able to eventually develop genetic markers and selectively breed shellfish stocks that accumulate little or no PST in a given region, reducing paralytic shellfish poisoning incidents and harvest losses, as well as be able to predict the evolution of resistance in areas that have only recently experienced paralytic shellfish poisoning outbreaks," commented Monica Bricelj, lead author on the study.

Through its ECOHAB program, NOAA conducts and supports state-of-the-art research on harmful algal blooms around the coastal U.S. An interagency program, which also includes the Environmental Protection Agency, National Science Foundation, National Aeronautics and Space Administration, and the Office of Naval Research, ECOHAB is managed by NOAA's National Ocean Service, National Centers for Coastal Ocean Science, Center for Sponsored Coastal Ocean Research. ECOHAB seeks to produce new detection methodologies for harmful algal blooms and their toxins; understand bloom causes and dynamics; develop forecasts of growth, transport, and toxicity; and predict and mitigate impacts to living marine resources.

NOAA is dedicated to enhancing economic security and national safety through the prediction and research of weather and climate-related events and providing environmental stewardship of the nation's coastal and marine resources.

On the Web:

NOAA: <http://www.noaa.gov>

NOS: <http://www.nos.noaa.gov>

Northwest Fisheries Science Center HABs: <http://www.nwfsc.noaa.gov/hab/>

ECOHAB: <http://www.cop.noaa.gov/stressors/extremeevents/hab/current/fact-ecohab.html>

National Centers for Coastal Ocean Science, Center for Sponsored Coastal Ocean Research:
<http://www.cop.noaa.gov/>